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(54) Tyre removal machine for tyres of "system pax" type and the like

(57) A tyre removal machine comprising a base (2), a rotatable shaft (5) projectingly emerging from the base to support the wheel rim, a column (3) supporting a horizontal first bar (6) slidable relative to the column, a vertically slidable second bar (7) at the end of the first bar, tools positioned at the end of said second bar for acting on the tyre bead, and a carriage (21) which slides on the base in a direction parallel to the rotatable shaft and carries a vertically slidable plate carrying means for supporting the wheel in a vertical position with its axis lying in the vertical plane containing the rotatable shaft (5).

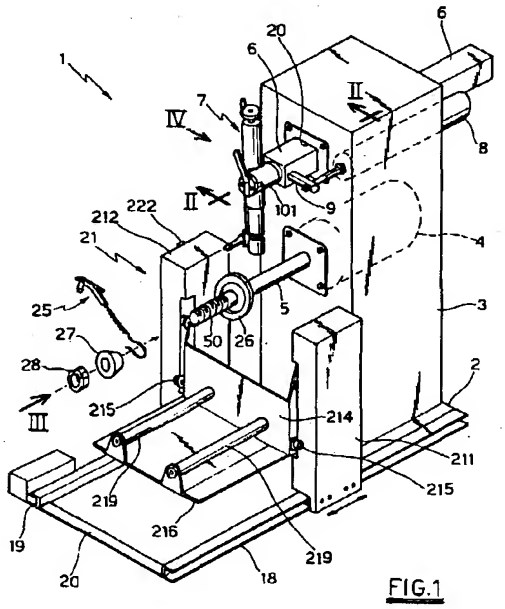


FIG.1

EP 1 048 496 A1

Description

[0001] This invention relates to machines for mounting and removing a tyre on and from a wheel rim, and in particular to machines able to operate on that new type of tyre which enables the vehicle to travel even if the inflation pressure is deficient.

[0002] Tyres of the stated type, such as the System Pax tyre produced by Michelin, enable the vehicle to travel even when their inflation pressure is very low or close to zero, as in the case of a puncture.

[0003] These tyres comprise not only the outer carcass but also a separate toroidal support ring of elastomer rubber, which is housed in an appropriate seat provided in the well of the wheel rim.

[0004] To enable the tyre and the toroidal support ring to be mounted on the wheel rim, both the wheel rim and the tyre have special profiles.

[0005] Specifically, the tyre has different diameters across the beads, with the result that the wheel rim is not symmetrical about the plane passing through its centre, the seats for receiving the beads being of different diameters.

[0006] These special new tyres, which are described in French patent applications FR 92/15061 and FR 93/14702, are encountering increasing interest by automobile manufacturers because of their intrinsic characteristics, the intention of these manufacturers being to use them as standard on their automobiles.

[0007] However, to remove or mount these special tyres from or on the wheel rim, a procedure has to be followed which cannot be implemented with tyre removal machines of traditional type because of the asymmetry of the tyre beads and the need to insert the toroidal ring.

[0008] Consequently, tyre removal machine manufacturers provide equipment for fitting to traditional tyre removal machines to enable this new type of tyre to be mounted and removed on and from the respective wheel rim.

[0009] However, because of the large weight of the tyre, which can reach 50 kg, known machines even though provided with the said equipment require the operator to exert considerable physical force to position the tyre on the machine.

[0010] An object of the invention is to overcome the aforesaid drawbacks within the framework of a rational and reliable solution, which simplifies and accelerates the work of the operator.

[0011] This and further objects are attained according to the invention by a machine having the characteristics defined in the claims.

[0012] The operational and constructional characteristics will be apparent from the ensuing description of a preferred embodiment thereof given by way of non-limiting example and illustrated on the accompanying drawings.

Figure 1 is a perspective view of the tyre removal machine of the invention.

Figure 2 is a section on the line II-II of Figure 1.

Figure 3 is a front view of the tyre removal machine of the invention.

Figure 4 is an enlarged view of a detail of the invention.

Figure 5 is a section on the line V-V of Figure 3.

Figures 6, 7, 8, 9 and 10 show in succession the steps involved in mounting the tyre on the wheel rim using the machine of the invention.

[0013] Said figures show the tyre removal machine, indicated overall by 1 and comprising a base 2 from which there rises a column 3 the interior of which houses a pneumatic motor 4 provided with a usual step-down gear, the horizontal shaft 5 of which emerges from the front of the column 3 and is arranged to receive the hub of the wheel rim C, as shown in Figure 3.

[0014] In proximity to its upper end the column 3 comprises two opposing rectangular holes 20 which receive a movable bar 6 of rectangular cross-section supporting at its front a telescopic bar 7, to the lower end of which the tools used in mounting and removing the tyre are fixed.

[0015] The bar 6 can traverse horizontally, driven by the pneumatic cylinder-piston unit 8 positioned within the column 3 and having its rod 6 connected to said bar 6 by the bar 9.

[0016] With particular reference to Figure 2, the bar 2 has at its front a stem 60 of circular cross-section, on which there is mounted a sleeve 10, to the outside of which the tube 70 of the telescopic bar 7 is welded.

[0017] The sleeve 10 can rotate about its axis, to be locked in two different angular positions such as to locate the telescopic column 7 in a first position in which its axis is substantially vertical and in a second position in which its axis is substantially horizontal.

[0018] For this purpose the sleeve 10 comprises two recesses 100 and 101, shown in Figures 1 and 2 respectively, which are angularly spaced apart by about 90° to receive the front part of a locking lever 11 normally maintained in position by a spring 12.

[0019] The tube 70 is internally hollow and receives a shaft 71 adjustable in height by a worm, not shown, operated by a handwheel 72.

[0020] The shaft 71 lowerly carries the tools for acting on the tyre during its mounting and removal.

[0021] Said tools comprise an idle roller 13 of cylindrical section, its axis of rotation coinciding with the axis of the shaft 71, and a hook 14 the function of which is explained hereinafter and which is secured to the vertical wall of an L-shaped plate 15 fixed to the shaft 71

upstream of the roller 13.

[0022] With reference to Figures 3 and 4, the hook 14 is mounted on a threaded pin 150 extending from the plate 15 and is locked thereon by a nut 16 with an interposed spring washer, not shown.

[0023] This enables the hook 14 to be positioned horizontally as shown in Figure 2, or vertically as shown in Figure 3, depending on the operation to be carried out.

[0024] The plate 15 is also provided with two pegs 151 and 152 acting as limit stops for the hook 14.

[0025] From the plate 15 there extends a vertical rod 17 guided by a bush 700 welded onto the tube 70, on which an adhesive plate 701 carrying graduated marks 702 indicating different wheel rim diameters is attached. The purpose of said rod 17 is to indicate at which height the shaft 71 has to be set to match the diameter of the wheel rim to be operated upon.

[0026] Two mutually facing identical C-section bars are fixed to the sides of the base 2 and are joined together at their front by a bar 20.

[0027] The two section bars 18 and 19 act as a guide rails for the carriage 21, which receives and positions the wheel R. As shown in Figure 3, this carriage comprises two equal and opposite uprights 211 and 212, and is provided at its base with wheels 213 which run within said guide rails to enable the carriage 21 to move horizontally. The two uprights 211 and 212 are joined together by a vertical plate 214 which is secured to them by virtue of wheels 215 which enable said plate to move vertically. A platform 216 for supporting the wheel R extends frontwards from the plate 214.

[0028] The front edge of the platform 216 comprises two appendices 217 and 218, in each of which there is inserted one end of a pin of an idle shaft 219, the other end of the pin being inserted into the plate 214.

[0029] The vertical movement of the platform 216 is provided by two identical pneumatic cylinder-piston units positioned inside the uprights 211 and 212 respectively, their rods being connected by known means to the plate 214. The two cylinder-piston units 220 and 221, which are fed in parallel, are operated by opening a compressed air feed cock controlled by a lever 222 positioned on the upright 212.

[0030] The invention also includes the tool 25, which comprises two plates 250 and 251 joined together at one end to form an acute angle defining a seat for receiving the edge of the wheel rim. To the plate 250 there is fixed a spring 252, to the other end of which there is fixed a hook 253. A handle 254 for holding the tool 25 extends from the plate 250.

[0031] Figure 5 shows a wheel R mounted on the machine. The wheel R comprises the wheel rim C, having a seat for receiving the toroidal ring S, and on which the tyre P is mounted. The wheel rim C rests against a cup piece 26 welded to the shaft 5, and is maintained resting against it by a cone 27 and the nut 28, of quick locking type, which by being screwed onto the threaded portion 50 of the shaft 5 maintains the cone 28 in the position shown in Figure 5.

[0032] The tyre P and the ring S are mounted on the wheel rim C by the following operations.

[0033] Firstly the operator moves the carriage 21 manually along the guides 18 and 19 into its forward loading position. He then rests the wheel rim on the shafts 219 in a vertical position and with the smaller-diameter edge facing the column 3. He then moves the carriage 21 backwards until the wheel rim C lies at the front end of the shaft 5. At this point he turns the lever 222 to operate the cylinder-piston units 220 and 221, which move the platform 216 vertically to bring the hub of the wheel rim C in line with the shaft 5. Having reached the correct height the operator halts compressed air feed to the two cylinder-piston units and moves the carriage 21 rearwards until the wheel rim C rests against the cup piece 26, then he locks the wheel rim in position by the cone 27 and nut 28.

[0034] It should be noted that the two cylinder-piston units are pneumatic as this enables the operator to finely adjust the height of the platform on which the wheel rim C is positioned, by utilizing the compressibility of the air.

[0035] Figures 5, 6, 7, 8, 9 and 10 show the successive steps in mounting the tyre.

[0036] When the wheel rim has been fixed in position, the operator mounts the larger-diameter bead 300 of the tyre P and the toroidal support ring S onto the wheel rim 8, as shown in Figure 6.

[0037] At this point the operator sets the telescopic bar 7 in its horizontal position and causes the bar 6 to advance so as to move the telescopic bar 7 to the left of the wheel rim, as shown in Figure 6, then he vertically repositions the bar 7.

[0038] Then, using the already described means, he adjusts the height of the roller 13 on the basis of the wheel rim diameter, and then moves the bar 6 rearwards to bring the roller 13 into contact with the bead 301 of the tyre P, and forces that bead portion in contact with the roller 13 into its seat 400 in the wheel rim.

[0039] The tool 25 is used to facilitate the insertion and retention of the entire bead 301 in the seat 400 in the wheel rim C. The tool 25 is held in the position shown in Figures 5 and 7 and the shaft 5 is made to rotate through about 360°. By virtue of the pressure exerted by the roller 13 and the retention action of the tool 25, the entire bead 301 becomes inserted into the seat 400.

[0040] Simultaneously the ring S moves until it rests against the projecting edge 401 of the wheel rim C, and the bead 300 moves into the channel 402.

[0041] Having done this, to complete the mounting of the tyre the operator has to insert the bead 300 into the seat 403 in the wheel rim C.

[0042] For this purpose he has firstly to extract the bead 300 from the channel 402. To do this he positions

the telescopic bar 7 between the edge 404 of the wheel rim and the column 3 then, as shown in Figure 8, he places the hook 14 in a horizontal position and grips the bead 300 with it.

[0043] The operation is facilitated by slightly raising the platform 216 so as to raise the bead 300 from the channel 402. He then withdraws the bar 6 and rotates the shaft 5 to bring the bead 300 to the outside of the wheel rim, as shown in Figure 9.

[0044] At this point the bead 300 has to be inserted into the seat 403, which, after vertically repositioning the hook 14, is done by carrying out the same operations described for inserting the bead 301 into the seat 400.

[0045] To remove the tyre from the wheel rim, the wheel R is positioned as in Figure 5, after which the following operations are carried out:

- the tyre is deflated,
- the wheel is put in the working position shown in Figure 5,
- the roller 13 is brought into contact with the bead 301 and the bar 6 is withdrawn slightly in order to create a gap between the bead and the edge of the wheel rim C, into which a usual lever is inserted,
- the shaft 5 is rotated through about 20° and a second lever is inserted,
- using the two levers a portion of the bead 301 is extracted from the wheel rim,
- the bar 7 is positioned on the other side of the tyre,
- the roller 13 is placed in contact with the tyre bead 300, the bar 6 is advanced and the shaft 5 rotated to move the bead 300 beyond the projecting edge 401,
- at this point the tyre can be withdrawn from the wheel rim together with the toroidal ring S.

[0046] Finally it should be noted that the motor 4 can be either pneumatic or electric, and that the operation of the bar 6 is controlled by a usual pedal unit 30 shown in Figure 3.

Claims

1. A tyre removal machine comprising a base, a rotatable shaft projectingly emerging from the base to support the wheel rim, a column supporting a horizontal first bar slidable relative to the column, a vertically slidable second bar at the end of the first bar and, positioned at the end of said second bar, tools for acting on the tyre bead, characterised by comprising a carriage which slides on the base in a direction parallel to the rotatable shaft and carries a vertically slidable plate carrying means for supporting the wheel in a vertical position with its axis lying in the vertical plane containing the rotatable shaft.

2. A machine as claimed in claim 1, characterised in that said second bar is a telescopic bar having its outer part associated with the first bar in such a manner as to be able to be set in a horizontal position or in a vertical position, means being provided to lock said outer part in the selected position.

3. A machine as claimed in claim 1, characterised by comprising a separate tool composed of two plates joined together at an acute angle to form a seat for receiving the edge of the wheel rim, and elastic means terminating with a hook intended to engage said rotatable shaft.

4. A machine as claimed in claim 1, characterised in that the tools positioned at the end of said second bar comprise an idle roller coaxial with said second bar and a harpoon hook arranged to assume a first position in which it projects laterally from said second bar, and a second position in which it is parallel to said second bar.

5. A machine as claimed in claim 4, characterised in that said hook is shaped as a harpoon with a rectilinear shank.

6. A machine as claimed in claim 1, characterised in that the slidable part of the second bar comprises a threaded seat into which there is screwed a threaded rod rotatable about the fixed part of said second bar and associated with an operating handwheel.

7. A machine as claimed in claim 1, characterised in that said rotatable shaft is operated by an electric motor.

8. A machine as claimed in claim 1, characterised in that said rotatable shaft is operated by a pneumatic motor.

9. A method for mounting asymmetric tyres on their respective wheel rims by the machine claimed in claims 1 to 6, characterised by comprising the following operations:

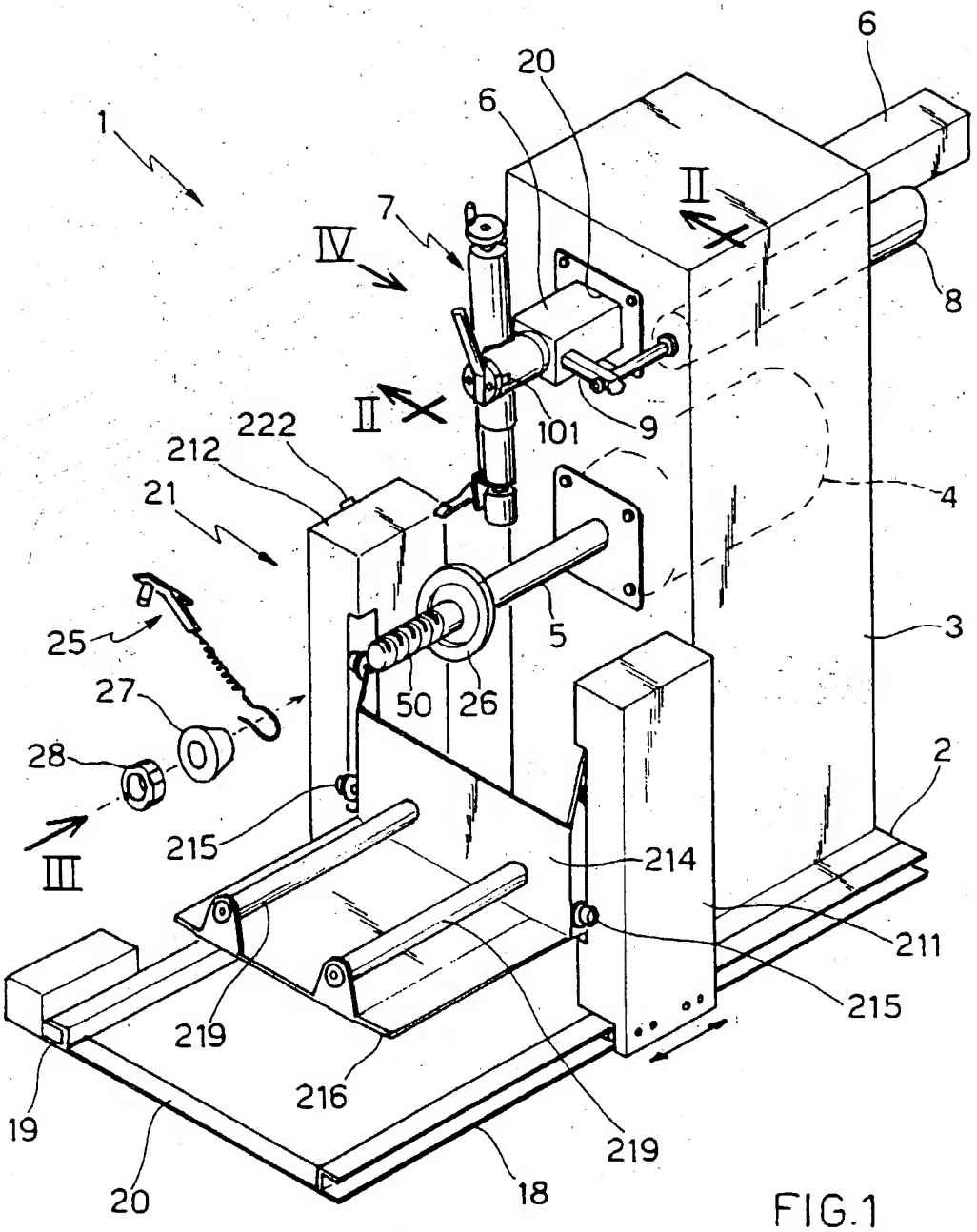
   - when the wheel rim has been fixed onto the rotatable shaft with its larger-diameter edge facing the machine column,
   - the operator mounts the larger-diameter bead of the tyre P and the toroidal support ring S onto the wheel rim 8;
   - he sets the telescopic second bar in its horizontal position and causes the first bar to advance so as to move the second bar to that side of the wheel rim distant from the column;
   - he vertically repositions the second bar;
   - he adjusts the height of the idle roller positioned at the end of the second bar on the basis

of the wheel rim diameter;

- he moves the first bar rearwards to bring the idle roller into contact with the smaller-diameter bead of the tyre P and forces that bead portion in contact with the idle roller into the facing seat in the wheel rim;
- he detaches the tool and positions it astride the edge of the wheel rim, fixing it elastically to the rotatable shaft, and
- rotates the rotatable shaft through about 360°;
- he positions the second bar between the larger-diameter edge of the wheel rim and the column on the base;
- then he holds the hook 14 in a horizontal position and inserts it under the larger-diameter bead of the tyre;
- he extracts said bead from the edge of the wheel rim by withdrawing the first bar and rotating the wheel rim through about 360°;
- after vertically repositioning the harpoon-like hook he reinserts the bead into the seat in the wheel rim from the outside by carrying out the operations described for inserting the smaller-diameter bead.

10. A method for removing asymmetric tyres from their respective wheel rims by the machine claimed in claims 1 to 6, characterised by comprising the following operations:

- the tyre is deflated,
- the wheel is placed on the rotatable shaft,
- the idle roller is placed in contact with the smaller-diameter bead and the first bar is withdrawn slightly in order to create a gap into which a usual lever is inserted,
- the rotatable shaft is rotated through about 20° and a second lever is inserted,
- using the two levers a portion of the bead is extracted from the wheel rim,
- the rotatable roller is brought into contact with the larger-diameter bead 300, the first bar is advanced and the rotatable shaft rotated to move the larger-diameter bead beyond the projecting edge against which the toroidal ring rests,
- at this point the tyre can be withdrawn from the wheel rim.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101
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21
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FIG.1

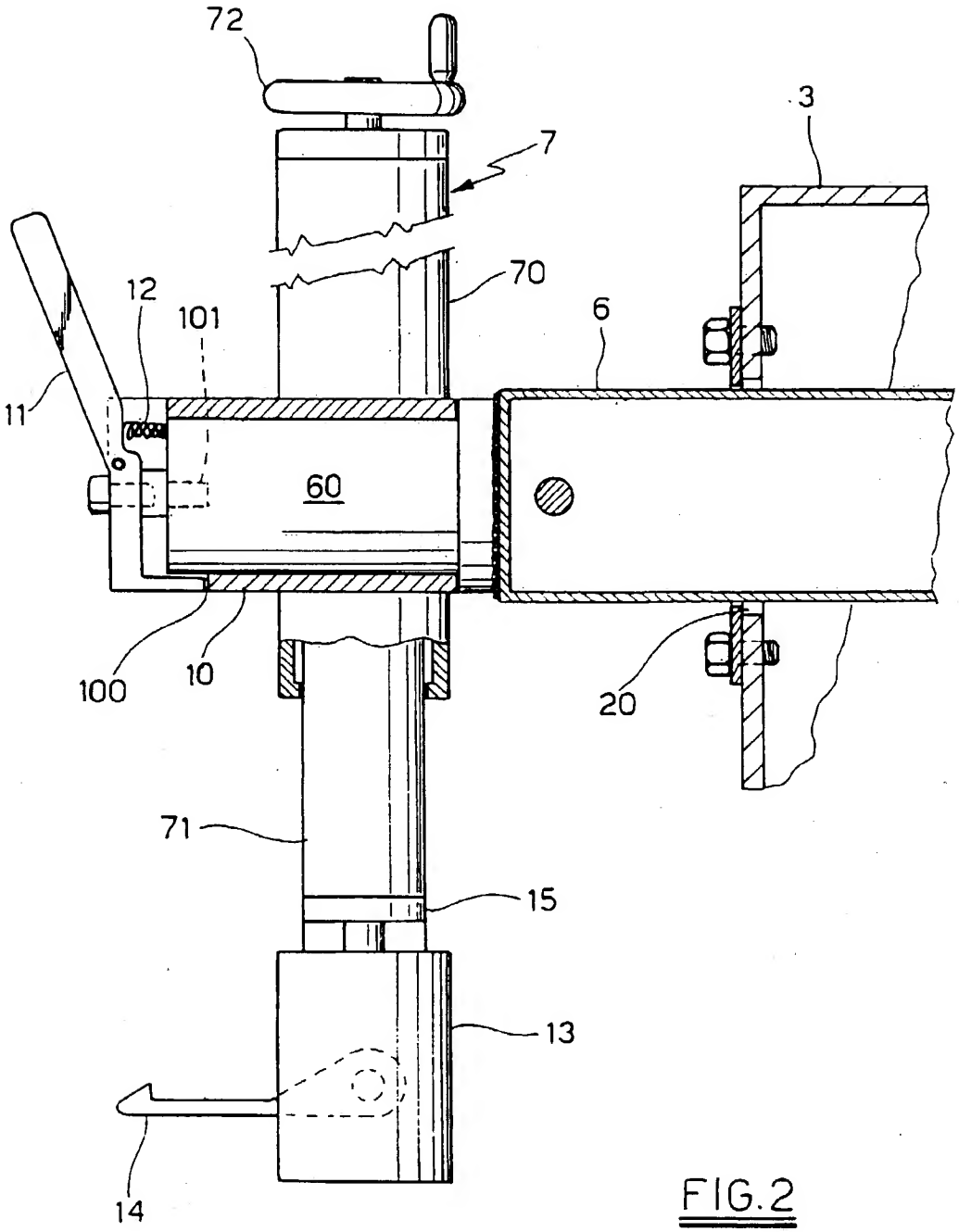
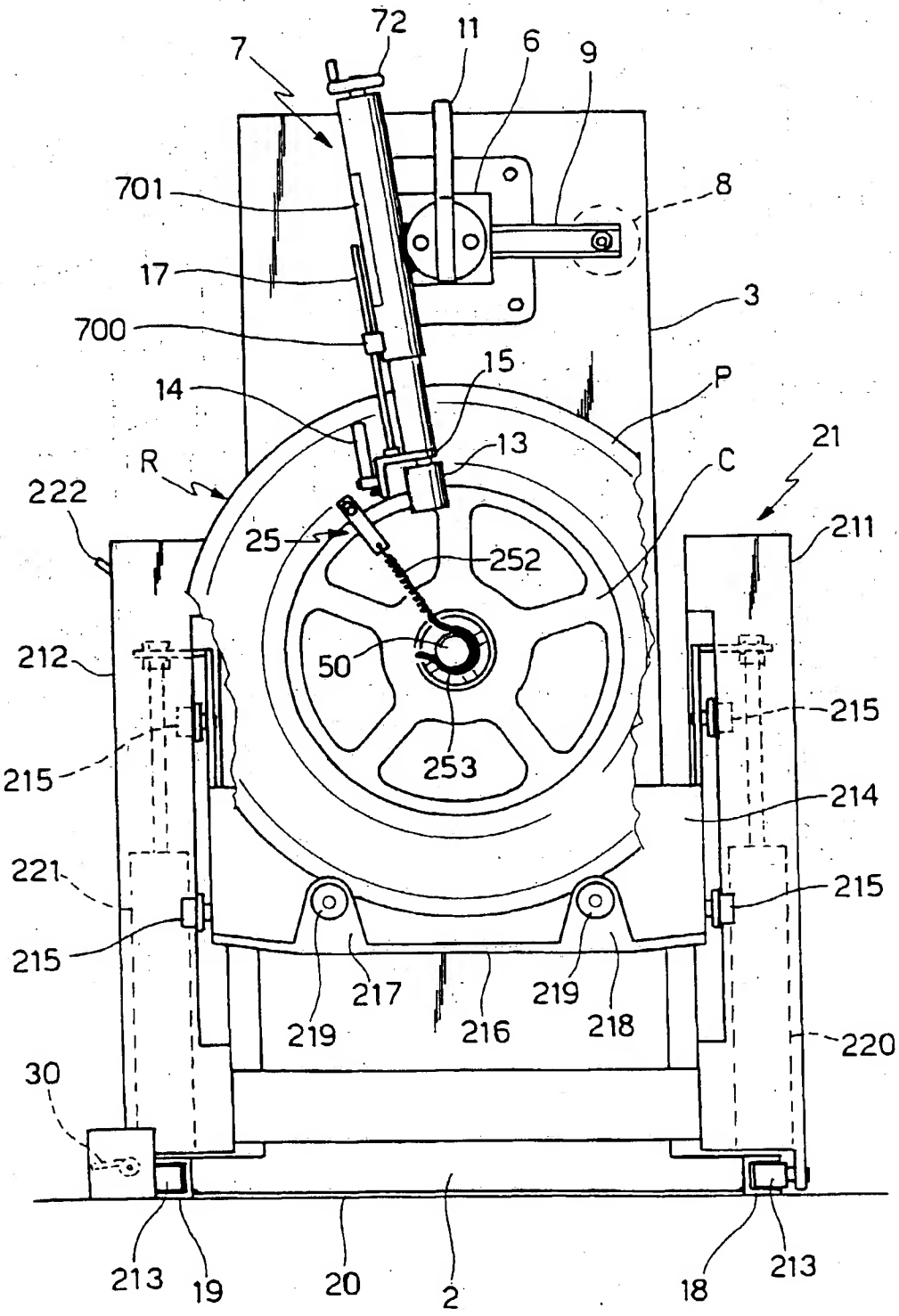


FIG.2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50
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2
18
213

FIG.3

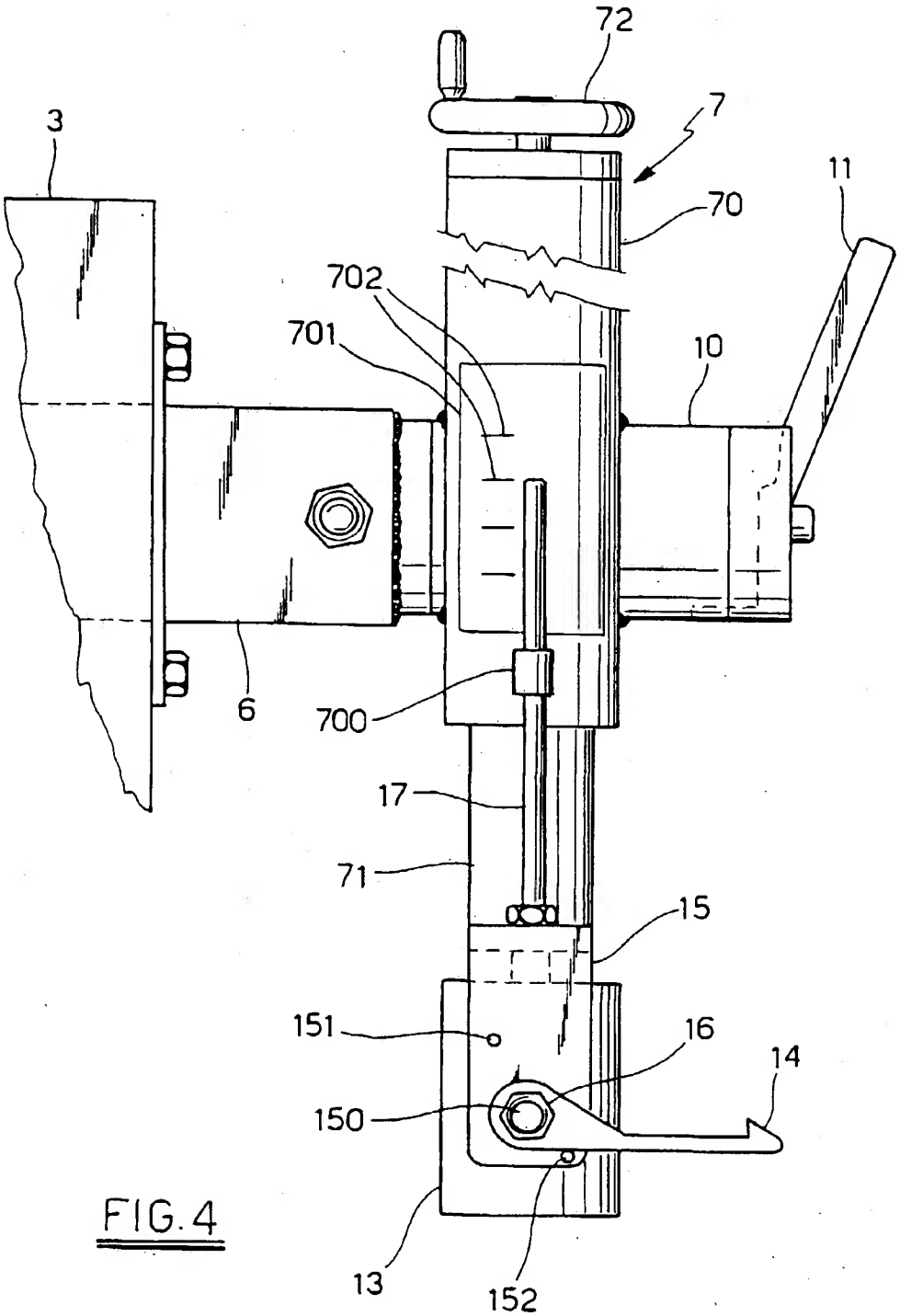

FIG.4

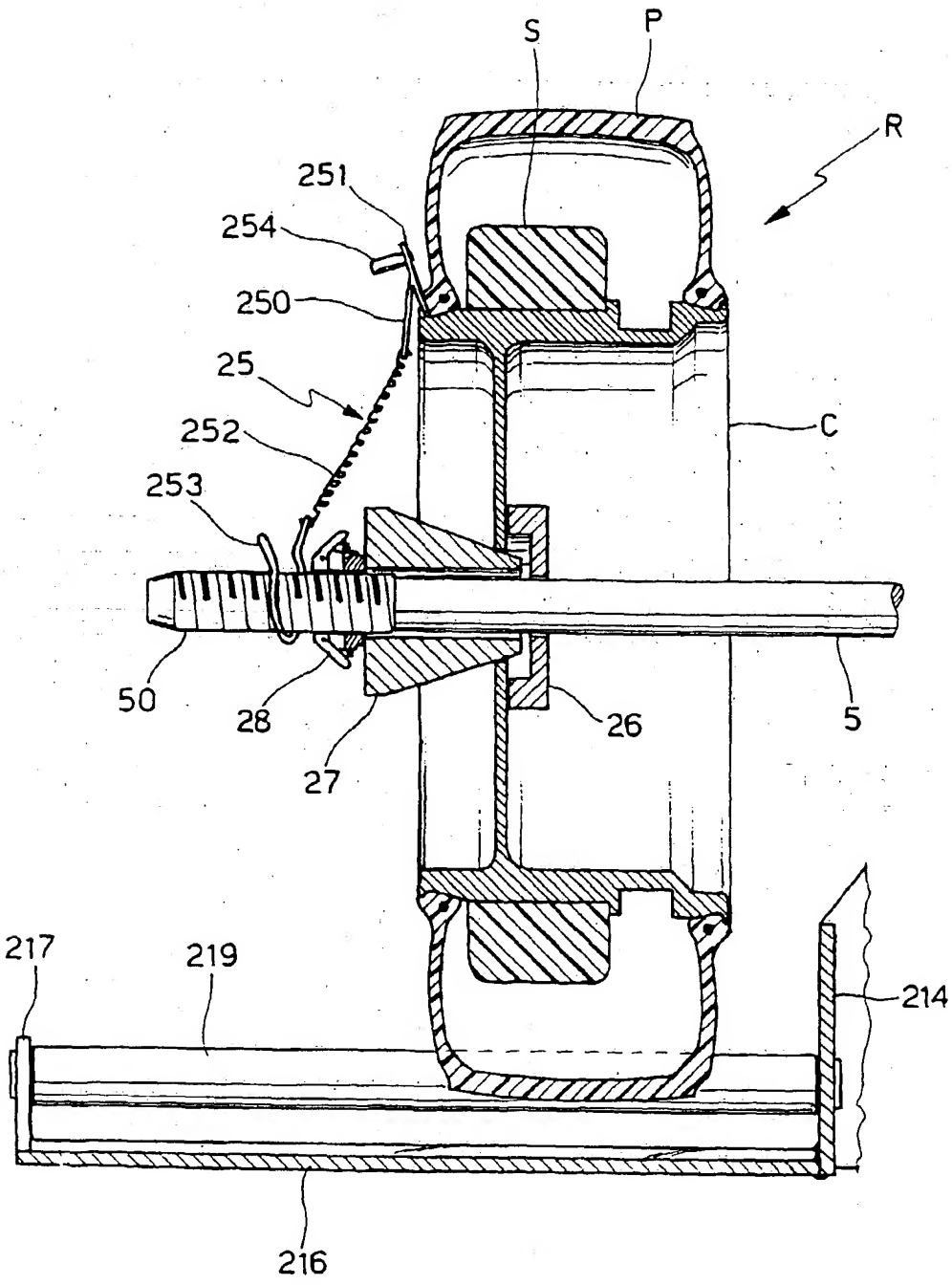

FIG. 5

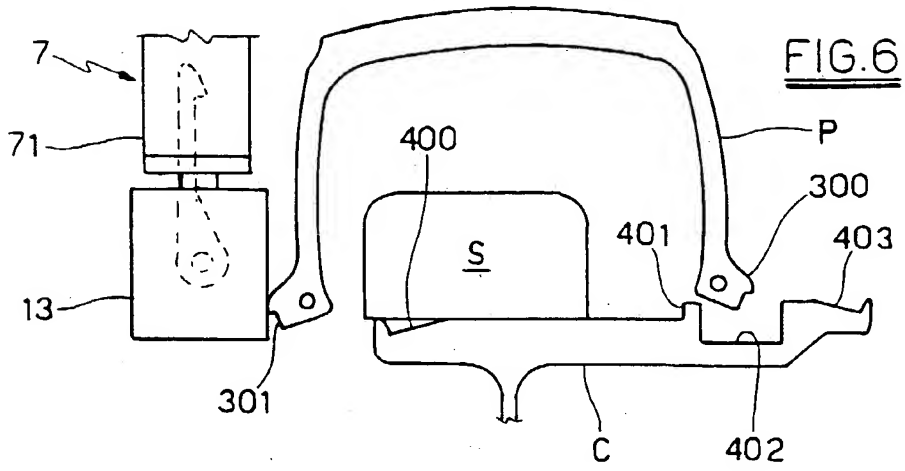

FIG.6

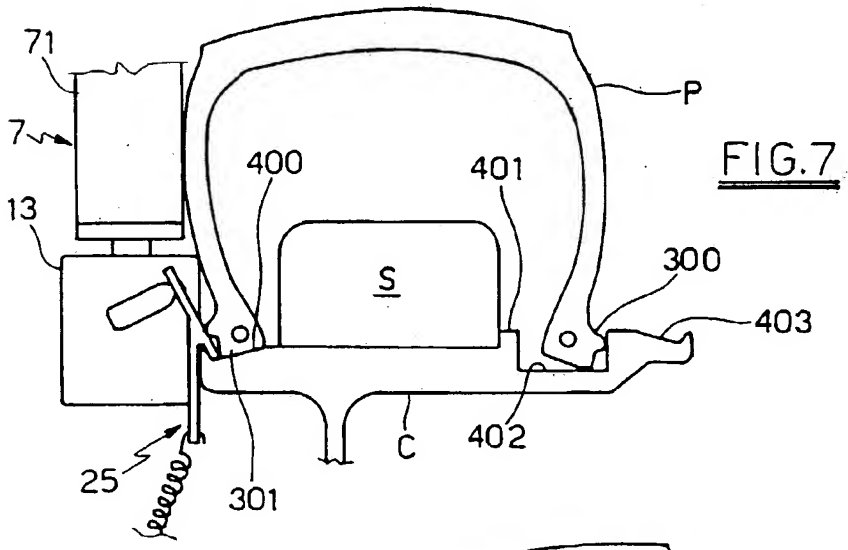

FIG.7

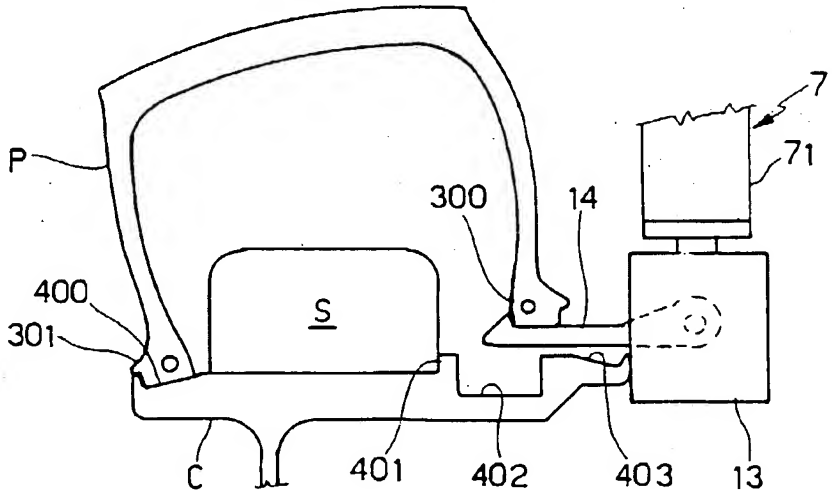

FIG.8

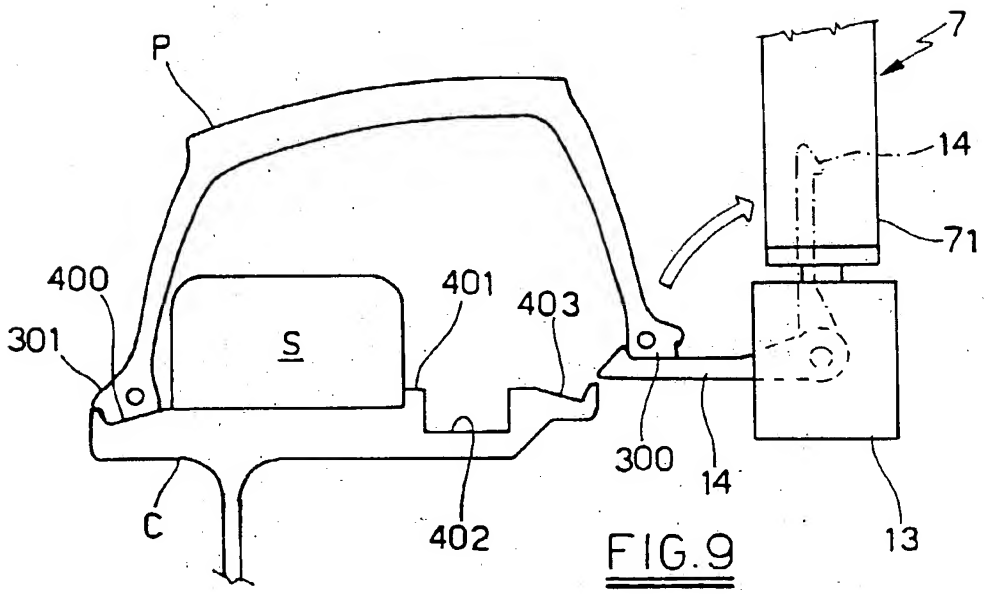

FIG.9

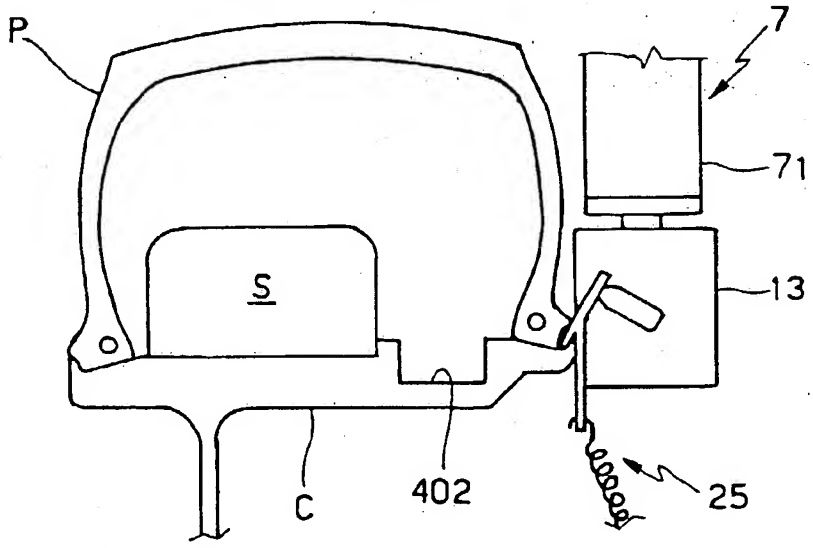

FIG.10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 20 1014

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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B60C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 August 2000	Smeyers, H

CATEGORY OF CITED DOCUMENTS

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